

SEQUENCE LISTING

<110>

<120> The polynucleotide sequences encoding full length of chicken type II collagen and use thereof

<130> IEC030029PCT

<160> 3

<170> PatentIn version 3.1

<210> 1

<211> 5495

<212> DNA

<213> genomic DNA

<400> 1	ccaggcaagg atggcgacg tgtaagtggg geacggccat ggggtgggct ggcaaaggat	60
gctcacagag accacatctt catctcttc tctctccat agggcttgcg gggtccatt	120	
ggtccccctg gccctgtgg ccccaacggg gageagggtga gagcagcata acagcacccc	180	
acattacggc ccatgggatg accccagtgc ctccacccctt ccatcccttcc tttccagg	240	
tgaatccggc ctcctgttc catctgggtgc tgccgggtgc cgtgggtgcc ccgttaagcac	300	
aatgtctgca gcccctgggt gcccctaacc ttcaccctaa accccataa accccctttat	360	
caacccccc cattatccctt cattagggtg agcgtggcga gcccgggtgcc cccggccctg	420	
ctggatttgc tggcccccgg gtgaggtttt caccggcgg accccatcgc acacccacgt	480	
cttcacccca cattatccacc ccactcatgg tggctgtgt tcccatcagg gcgccgttgg	540	
acaacccggg gccaaaggcg agcagggaga gcccggggcgg aagggtgacg cggggctcc	600	
tggtccccaa ggtccctccg ggcgtccctgg ccccccaggta caacacccaa tggggcaaac	660	
ccccaaattt gggacgtcac ggcggcaatg caggcacact gcagctcccg ttcggattttg	720	
taacctgttt ttctctccctt cctagggttcc aaccgggttgc actggccccaa eaggagctcg	780	
tggggctcag ggtccccctg ttagtacccgg ggggtgggct gcagggtggg gaaggagcgg	840	
ccgtzgggctt gagctgtgtc tgagccgttt ctccctccctt tctctcttgc gactctgtga	900	
ttccctcccc agggagccac gggattcccc ggagctggc ggcgtgtggg accggccggc	960	
cctaattgtga gtctgggggc ttctctggat tgcggccacc tggggtttgg ggcgtgttcc	1020	
cccgccgtgc gtgttggagg gggactgttt tccctgcaca gacacgtggg tttttctcc	1080	
ttggctctctt gatgttggct ttggggcca ttccaaatgtt agagaaggac ttttctaagg	1140	
gcaagagctc cccaagaaggc agcagtggga tgcgggtgtt aaagatggaa tggctgcctc	1200	
tggtttgcac caacgcgtctt tttagggtaac ccaggcccccc cccggacccccc	1260	
cggtctgtctt ggcaaaaggac gcccgggggg tggctgtggc gacggccggcc ccccccggc	1320	
tgcagggtac cccggccctcc aaggcccccc cggccccccc ggcgagaagg gcaacccgg	1380	
cgaggacggc cccgggggtga ggtttctggg ggtctccctt ctccgtgcac ccctggctg	1440	
cggtgtgtcc ttgttcttag tctgatttcc ccctctgtgt ccctgcagggttcccgacggc	1500	
ccccccccggc cctcaagggtt tggcaggaca ggcgtggattt gttgggttcc caggacagcg	1560	
tggtgagaga ggcttccccgg gactgggggg gccatgggtg agtgggtgcgc tctcatttgg	1620	
gtgcactgaa tccatgggg tgcagagatg tggggccgc gatgtctgg agcccatctc	1680	
aggggtcgcc agcccttgg tgcagccgg ggacacccgtt tgcagggtggg ttggggttt	1740	

iec030029pctseq.txt

gcggagctcc	ttttccccca	ccaggagccg	ctggtgcaag	gcttaaagcc	ggggcagggaa	1800
aaccatcagt	gttatttgt	tgaggggg	tctgggagcc	ataaaaaaacg	ggaaaggggc	1860
agcgctgggg	tctctccac	tcatgcacct	ctttccatc	tttcagggag	aacctggaaa	1920
gcaaggagcg	cctggctctg	cgggtgaccg	aggcccccc	ggccccgtgg	gccccctgg	1980
gctgacaggt	cctgctggag	aaccgggag	cgaggtaaagc	aaaacccac	agcatcacag	2040
cgccaccggg	catcaccaac	ccccatggcac	agctcagctc	ccagagctcc	ccggtgtctt	2100
tttctccage	actgaaagga	gactttgcac	aaatcctgt	ccacccgggt	tgtaacatcc	2160
ccctttcctc	ctagggcaac	cctgggtctg	acggcccccc	aggcagggt	ggcgcaagctg	2220
gcgtgaaggt	gagtttgcac	tgcgttcccc	attggcactc	gccatccccg	tgccaaaagc	2280
tgtgggttt	tgcacagatc	tgacccctct	gttgtctgt	cgcagggtga	tcgtggtag	2340
acccggccctg	ttgggtctcc	cgggtctct	ggageccctg	gcccggccgg	ccctgttgg	2400
cccaactggaa	aacaaggaga	cagaggcgag	acggtgagtg	ctggcacaag	ggtttagggt	2460
ttagggtctc	ttatggctg	aaaatgtgca	ggggttcccc	tcaagggttt	ttcccttgac	2520
cagtgttag	tgcattttaa	gatgtgtga	ggcaccaaca	gctgtgtatt	gtcactgttg	2580
cccggtctg	gggtgcggag	catggggctg	gctcagacac	ccccgaaatc	ccaaattcat	2640
ggcttcgagg	ttgtgtttct	ggtcgtggc	acccctgtat	gtcccttttt	tctccctgca	2700
gggtgcacaa	ggggccatgg	gtccctctgg	tcccgctgga	gctcgaggaa	tgccgggttag	2760
tgggtcttag	tgcacatggca	cattccacgt	acagagcggt	gggtccctgcg	tgccaggagg	2820
gggtctgcca	ccctgagccc	gacacagccc	tgtccccact	ttagggttccc	caaggacetc	2880
gtgggtacaa	aggtagagacg	ggagaggctg	gagagagagg	gctgaagggc	caccgcggct	2940
tcacccggct	gcagggctcg	cccgaccac	ccgttaaggtt	gtttggggag	cactgagccc	3000
ccccccctgt	acgatgcggc	tcccttgggg	tctctgtggc	caccggatgt	ctgtctggcc	3060
caaagtgtg	acccgacagc	tgtgaccacc	ccggcttcc	cctcaggggcc	cgtctggaga	3120
ccaaagggtgt	ggccgtcccg	ctggtccctc	cggtccccaga	gttaaggctg	acgggtgtgt	3180
ttgggggttgt	ggaaaggggaa	ggagcagcag	tggctccct	gggcacctgc	agccctgttt	3240
cgtccctgtc	tgctcatcag	caccatcgcc	tccctgccc	tgaggccccg	caatgccccc	3300
accccccgt	tttggggctc	tctcttaggg	tcccccttgt	cccggtggcc	ccctctggcaa	3360
agacggctct	aacggcatgc	ccggcccat	cggtccccc	ggccccctgt	gacggagtgg	3420
tgaacccggc	cctgcggtga	gtccctgtga	ggggaggcag	ggaatgggg	ccagctcgca	3480
gagcagccca	tcaagcatc	ttctttccccc	catagggtcc	tcttgaaac	cccggtctcc	3540
ccgggtctcc	ttggcccccc	ggcacccggca	tcgacatgtc	tgcttttgt	ggactgggtc	3600
agacggagaa	ggggcccgac	cccatccgct	acatggggc	agacgaggcg	ggccggaggcc	3660
tgcggcagca	cgacgtggag	gtggacgcca	ccctcaaaatc	cctcaacaat	cagattgaga	3720
gcateccgcag	ccccggggcc	tccaaagaaga	accctggcc	gacctggccgc	gacatcaaacc	3780
tctgcctatcc	cgagtggaaag	agcggttaaga	gttccggctg	cctctccctgt	cctcccccct	3840
tccccacagg	agacccatccc	cagcgctctc	gacccgaccc	gccccgtttagt	ttggatgttag	3900
gaaagattcc	ttgtccaaaa	gagctctggg	cgctgggtctg	ggctggccgg	ggaggtgggg	3960

iec030029pctseq.txt

cagtgcgtgt	ccccataggt	gttggggAAC	tgtggagatg	tggcacttgg	gagcgtggct	4020
tagtggggat	gaggcagcag	ttggaccaat	cttcgaggtc	tttccagtc	ttaatggctc	4080
tgtgtttctg	tcggtgtgt	tggtggatg	gggtggccat	ttagacttgg	cgatcttga	4140
ggtttttcc	gatcttaacg	actccatagac	ctcccccaacc	ccatgaacgc	tgtttgtct	4200
ccccctgtca	ggagattact	ggattgaccc	gsaccaggc	tgcaccccttgg	acgccccatcaa	4260
atgtttctgc	aacatggaga	caggcagac	ctgegtctac	ccgacccccc	gcagcatccc	4320
caggaagaac	ttgtggacca	gcaagacgaa	agacaagaag	cacgttgggt	ttgcagagac	4380
catcaacggc	ggtttccacg	tgggtgtccc	ccgggtgtcc	ttggaaggat	cgatcccacc	4440
tggatgtcc	ttcttgcgt	catgtggatg	ggttttatg	sagttataga	gggtgtattct	4500
gaagggttag	ttttgggica	gttcagtc	scaaatcaaa	gggaaaggat	gggatggagc	4560
aactgagctc	cctcggttttgc	tttggcccaag	aaaagggttag	gatgaggggg	ggcctcacgg	4620
ccctacagcc	ccttacggcc	ctacagcagc	gttagaaaaa	aagttctgcc	coggagctgt	4680
gttgggcaca	aaacagccct	gtgtatgcgg	agctcgggg	gcattgggac	aacgcctctca	4740
gacattgggt	ttgggtcagg	ttcttggtaa	cgtgtatgtc	agggggcaac	cagccatgg	4800
gtgggcttta	aggacccttc	caagccaacc	attccatgtt	tctgtgtatct	gtaggaccc	4860
ttccsatecca	aaccactctg	attttttct	cagccatttg	ggaacctgaa	gtacggaaat	4920
cctcccaaaa	agctcctgag	agtaagggtgg	tcataatgcc	cgcaggctt	aaatccctcac	4980
ctcttccctc	cagtccatgt	acggcgatga	gaaacctgtcc	cccaacacgg	ccagcatcca	5040
gtgacettc	ctgcgcctcc	tgtccacccg	gggctcccaag	aacgtcacct	accactgca	5100
gaacagcata	gcctacatgg	acgaggagac	gggcaacctg	aagaagccca	tcctcatcca	5160
gggatccaac	gacgtggaga	tcagagccga	gggcaacacgc	aggttccacct	acagcgtt	5220
ggaggacggc	tgcacggtag	tttgcgggc	gcctgcaag	gaaagggtgca	gatggggagg	5280
ggggaggctga	ggctgggggg	atgaggccgg	agcagctgac	agcatccctg	ccctcccttcc	5340
cctccccagaa	acacactggc	aaatgggca	agacggtgat	cgagtacccg	tgcagaaga	5400
cctcgccct	gcccatgtt	gatattgcac	ctatggacat	tggcgagcc	gatcaggagt	5460
ttggcgttgg	tattggccca	gtctgtttct	tgtaa			5495

<210> 2
<211> 4793
<212> DNA
<213> cDNA

<400> 2	atgcacggcc	ggccggccggcc	ccgcgtccggcc	gtcttcctcc	tccttccttc	cccttcacg	60
	ggccggccaa	ccgcgcgagga	ccgcgcaccc	cgacaaacctg	gcccccaagg	acagaaggga	120
	gaacccggag	atattaaaga	tgtttagga	ccccgagggc	ctccaggacc	acagggccca	180
	gcaggagac	agggacagcg	aggggaccgt	ggcgagaagg	gggagaagg	tgctccgtgc	240
	ccccgtggga	gggatggaga	acccggcacc	cctggaaacc	caggcccccc	cggccccccc	300
	ggacccctcg	gccccccgg	acttggtgg	aactttgcgg	cgcagatggc	ggggggcttc	360
	gatgagaagg	cgggtggagc	gcagatgggt	gtcatgcagg	gacccatggg	ccctatggga	420
	ccccggggcc	ccccctggcc	cactggccca	cctggtcccc	agggatttca	aggcaacccc	480

iec030029pctseq.txt

ggtagcccg	gcgaacccgg	cgctgctgg	ccgatgggtc	cccgggacc	tccgggacca	540
cctggaaac	ccggtaacga	tggtagaca	ggcaaaccg	gcaaatctgg	tgaacgtggc	600
ccccccggcc	cccaggggcgc	tcgtggcttc	cctggactc	ctggtcctcc	cgagtgaaag	660
ggccaccgag	gctaccccg	tttggatgg	gccaaggag	aggcgggg	tccgtggagcc	720
aagggtgaat	ctggtttacc	gggtgagaac	ggttccccc	gccccatggg	acccctggg	780
ctgccccggag	agegaggagc	tccgggccc	tccggcggcc	ccgggtctcg	tggcaatgac	840
ggttccctg	gccctgtgg	accccttgg	ccgtcgcc	ctgcccgg	ccccggcttc	900
cccgaggccc	ccggttcaaa	gggtgaagcc	ggccccactg	gtgcacgggg	tcccgagggt	960
gcccaggac	cccgccggcga	atccggcacc	cccggtcttc	ccggcccccgc	tggcgeaccc	1020
gttaacccag	ggactgtatgg	catccccgtt	gccaagggtt	ggcggtgtgc	cccgggcatt	1080
gcaggcgctc	caggattccc	cgccccacgc	ggcccccccg	gaccccaagg	tgccacccgga	1140
ccactgggac	ccaaaggaca	gacgggcgaa	cccggtatcg	caggcttcaa	gggcgagcaa	1200
ggacccaagg	gctggacgg	ccccgttagga	ccccuagggt	ccccggggcc	ggctgggtgag	1260
gaaggcaaga	gaggagctcg	tggtaact	ggtgccggcc	gcccgtgtgg	cccccccgga	1320
gaaaggggcg	ctccctggcaa	ccgtggattc	cccgggcagg	acgggtgtgc	cgacccaaag	1380
ggtgcgtccag	gtgaacgcgg	ccccgtgtgt	ctcgccggtc	ccaaagggtgc	cacccgtgac	1440
cccggtacgtc	ccggagacgc	cggggtgc	ggagcgagg	gtctcaacgg	cccccggc	1500
gatgcgggac	ctcaaggc	acttgggtc	ctggcgtgg	tggcgecccc	1560	
ggcccccccg	gacctcgagg	tgctcggtgg	cagccctgg	tgtatgggtt	ccccggtccc	1620
aaaggcgcta	atggtgagcc	tggaaaagct	ggagagaaag	gactggccgg	cgccccagg	1680
ctgcggggtc	tgcctggcaa	ggatggggag	acgggagctg	ccggcccccc	tggacccgt	1740
ggtcctgtgg	gtgagagagg	agagcaagga	gccccggc	cttccggctt	ccagggactg	1800
cccggtaccac	caggtcccc	tggggagagc	ggcaaacccg	gagaccagg	tgttccgtga	1860
gaagccgtg	cccccggtct	tgttggtccc	agaggtgaac	gtggattccc	cggtgaacgc	1920
ggctctcccg	gtgcacccagg	gctgcagggt	ccccgtggc	tcccccggaa	ccccggcaci	1980
gacggacccs	agggtgcac	cggtccagcc	ggccccaacg	gtgcccagg	tcccccagg	2040
ctgcaggggaa	tgcccggtga	gagaggagca	gctggcatacg	ctggcctcaa	gggtgaccgg	2100
ggagatgtt	gtgagaaagg	acctgaggga	gctccaggca	aggatggcgc	acgtggtctg	2160
acgggtccca	ttggtcccc	tggccctgt	ggccccaacg	gtgagaagg	tgaatccggc	2220
cctccctggtc	cacgtgg	tgcctggc	cgtgtgtccc	ccgggtgg	tggcggcccc	2280
ggtgcctcccg	gtccctgtgg	atttgtggc	cccccggtcg	ccgatggaca	acccgggtcc	2340
aaaggcgagc	agggagagcc	cgggcagaag	ggtgacgcgg	ggcgtctctgg	tccccaaggt	2400
ccctccggcg	ctccctggcc	ccaggccca	accgggtgtca	ctggtccca	aggagctgt	2460
gggggtcagg	gtccccctgg	agccacgg	ttccccggag	ctgcggcc	tgtgggaccc	2520
cccggtccctaa	atggtaaccc	aggcccccc	ggacccctgt	gtctgtgtt	caaggacgg	2580
cccaagggtt	ttcgtggcga	cgccggcccc	cccggtcg	cagggtaccc	cgccctccaa	2640
ggccccggcc	gccccccccc	cgagaagg	gaacccggcg	aggacggccc	cgcggtccc	2700
gacggcccc	ccggccctca	aggcttggca	ggacagcgtg	gtattgtgg	tctccagga	2760

iec030029pctseq.txt

cacgcgtggtg	agagaggcct	ccccggactg	ccggggccat	cgggagaacc	tggaaagcaa	2820
ggagcgccctg	gtctcgcggg	tgaccgaggt	ccccccggcc	ccgtggggcc	ccctgggctg	2880
acgggtccctg	cgggagaacc	cgggcgcgag	ggcaaccctg	gtgctgacgg	tctccaggc	2940
agggatggcg	cagctggcgt	gaagggtgat	cgtggtgaga	ccggccctgt	gggtgcccccc	3000
gtgtccctg	gagccccctgg	cgccccggc	cctgttggtc	coactggaaa	acaaggagac	3060
agaggcgaga	cgggtgcaca	agggcccatt	ggtccctctg	gtcccgctgg	agctcgagga	3120
atgccgggtc	cccaaggacc	tcgtggtgc	aaaggtgaga	cgggagaggc	tggagagaga	3180
gggcgtgaagg	gccaccgtgg	cittcaccgg	ctgcagggtc	tgcgggacc	acccggcccg	3240
tctggagacc	aagggtgtgc	cgtcccccgt	gttccctccg	gtcccgagg	tcccccgtgt	3300
cccggtggcc	cctctggcaa	agatggctct	aacggcatgc	ccggcccccatt	cggtccctccc	3360
gttccccgtg	gacggagtgg	tgaacccggc	cctgcgggtc	ctcctggaaa	ccccgggtct	3420
cccggttctc	ctggcccccc	cggcaccggc	atgcacatgt	ctgtttttgc	tggactgggt	3480
cagacggaga	aggggcccgaa	ccccatccgc	tacatgaggg	cagacgaggc	ggccggaggg	3540
ctgcggcagc	acgacgtgg	ggtgatgcc	accctcaaat	ccctcaacaa	tcaatttgag	3600
agcatccgc	gccccggaggg	ctccaagaag	aaccctgcac	ggacctgcgc	cgacatcaaa	3660
citcgcacatc	ccgagtgggaa	gagcggagat	tactggatg	accgcacca	gggctgcacc	3720
ttggacgcac	tcaaagtatt	ctgcacatcg	gagacggcgc	agacctgcgt	ctacccgacc	3780
cccagcagca	tccccaggaa	gaactggtg	accagcaaga	cgaaagacaa	gaagcacgtc	3840
tggtttgcag	agaccatca	cggcggtttc	cacttcgt	acggcgatga	gaacctgttc	3900
cccaacaccg	ccagcatcca	gtgacatctc	ctgcgcctcc	tgtccaccga	gggctcccg	3960
aacgtcacct	accactgcac	gaacagcatc	gcctacatgg	acgaggagac	ggcaacctg	4020
aagaaaagcca	tccatcca	gggatccaac	gacgtggaga	tcaagccga	ggcaacacgc	4080
agggtcacct	acagcgtctt	ggaggacggc	tgcacgaaac	acactggcaa	atggggcaag	4140
acgggtatcg	agtaccgggt	gcagaaagacc	tcgcgcctgt	ccatttgata	tactgcaccc	4200
atggacattt	gcgggagccga	tcaggagttt	ggcgtggata	ttggcccaagt	ctgttttttg	4260
taaaaaagggt	tgttgttatt	tgttgtttt	tttgtttttt	gttttgtttt	tttttgtttt	4320
tttttttttt	tttttagaaa	agaaaaggaaat	ccagcccaat	cccataaaaag	caaaccaggc	4380
ccaccccccag	gacccgcacg	ttcccagcac	aacttctgc	ctgaacggat	ggcacgcaccc	4440
cgcccccctt	cgggaccctc	cggcgcgcgtc	accgggcaga	ctgcgaaata	caaccacggg	4500
cttatatttt	tttattgcct	tcttggaaagg	cctggtttcg	tagggcggtt	ggaggtggga	4560
atcaatctgg	cagggtgtac	ggccccccctc	cccacaaagg	gatctggcaa	acgcaggat	4620
cgcgaatccc	ctccccctcc	cgtgtatcac	cagcaggagt	gtataatgtat	cataacaacag	4680
aaatggtgct	attcttgtaa	aacaagtctg	tattttttaa	catcagttga	tataaaaaca	4740
acaaaaaaaaaa	aaacttttgg	tggaaagtaa	aaaaaaacaa	aaaaaaa	aaaaaaa	4793

<210> 3
 <211> 1420
 <212> PRT
 <213> chicken

<400> 3

Met His Gly Arg Arg Pro Pro Arg Ser Ala Ala Leu Leu Leu Leu
 1 5 10 15

Leu Leu Leu Thr Ala Ala Ala Ala Gln Asp Arg Asp Leu Arg Gln
 20 25 30

Pro Gly Pro Lys Gly Gln Lys Gly Glu Pro Gly Asp Ile Lys Asp Val
 35 40 45

Val Gly Pro Arg Gly Pro Pro Gly Pro Gln Gly Pro Ala Gly Glu Gln
 50 55 60

Gly Gln Arg Gly Asp Arg Gly Glu Lys Gly Glu Lys Gly Ala Pro Gly
 65 70 75 80

Pro Arg Gly Arg Asp Gly Glu Pro Gly Thr Pro Gly Asn Pro Gly Pro
 85 90 95

Pro Gly Pro Pro Gly Pro Pro Gly Leu Gly Gly Asn Phe
 100 105 110

Ala Ala Gln Met Ala Gly Gly Phe Asp Glu Lys Ala Gly Gly Ala Gln
 115 120 125

Met Gly Val Met Gln Gly Pro Met Gly Pro Met Gly Pro Arg Gly Pro
 130 135 140

Pro Gly Pro Thr Gly Ala Pro Gly Pro Gln Gly Phe Gln Gly Asn Pro
 145 150 155 160

Gly Glu Pro Gly Glu Pro Gly Ala Ala Gly Pro Met Gly Pro Arg Gly
 165 170 175

Pro Pro Gly Pro Pro Gly Lys Pro Gly Asp Asp Gly Glu Thr Gly Lys
 180 185 190

Pro Gly Lys Ser Gly Glu Arg Gly Pro Pro Gly Pro Gln Gly Ala Arg
 195 200 205

Gly Phe Pro Gly Thr Pro Gly Leu Pro Gly Val Lys Gly His Arg Gly
 210 215 220

Tyr Pro Gly Leu Asp Gly Ala Lys Gly Glu Ala Gly Ala Pro Gly Ala
 225 230 235 240

Lys Gly Glu Ser Gly Ser Pro Gly Glu Asn Gly Ser Pro Gly Pro Met
 245 250 255

Gly Pro Arg Gly Leu Pro Gly Glu Arg Gly Arg Pro Gly Pro Ser Gly
 260 265 270

Ala Ala Gly Ala Arg Gly Asn Asp Gly Leu Pro Gly Pro Ala Gly Pro
 275 280 285

Pro Gly Pro Val Gly Pro Ala Gly Ala Pro Gly Phe Pro Gly Ala Pro
 第 6 页

290

295

300

Gly Ser Lys Gly Glu Ala Gly Pro Thr Gly Ala Arg Gly Pro Glu Gly
 305 310 315 320

Ala Gln Gly Pro Arg Gly Glu Ser Gly Thr Pro Gly Ser Pro Gly Pro
 325 330 335

Ala Gly Ala Pro Gly Asn Pro Gly Thr Asp Gly Ile Pro Gly Ala Lys
 340 345 350

Gly Ser Ala Gly Ala Pro Gly Ile Ala Gly Ala Pro Gly Phe Pro Gly
 355 360 365

Pro Arg Gly Pro Pro Gly Pro Gln Gly Ala Thr Gly Pro Leu Gly Pro
 370 375 380

Lys Gly Gln Thr Gly Glu Pro Gly Ile Ala Gly Phe Lys Gly Glu Gln
 385 390 395 400

Gly Pro Lys Gly Glu Thr Gly Pro Ala Gly Pro Gln Gly Ala Pro Gly
 405 410 415

Pro Ala Gly Glu Glu Gly Lys Arg Gly Ala Arg Gly Glu Pro Gly Ala
 420 425 430

Ala Gly Pro Val Gly Pro Pro Gly Glu Arg Gly Ala Pro Gly Asn Arg
 435 440 445

Gly Phe Pro Gly Gln Asp Gly Leu Ala Gly Pro Lys Gly Ala Pro Gly
 450 455 460

Glu Arg Gly Pro Ala Gly Leu Ala Gly Pro Lys Gly Ala Thr Gly Asp
 465 470 475 480

Pro Gly Arg Pro Gly Glu Pro Gly Leu Pro Gly Ala Arg Gly Leu Thr
 485 490 495

Gly Arg Pro Gly Asp Ala Gly Pro Gln Gly Lys Val Gly Pro Thr Gly
 500 505 510

Ala Pro Gly Glu Asp Gly Arg Pro Gly Pro Pro Gly Pro Gln Gly Ala
 515 520 525

Arg Gly Gln Pro Gly Val Met Gly Phe Pro Gly Pro Lys Gly Ala Asn
 530 535 540

Gly Glu Pro Gly Lys Ala Gly Glu Lys Gly Leu Pro Gly Ala Pro Gly
 545 550 555 560

Leu Arg Gly Leu Pro Gly Lys Asp Gly Glu Thr Gly Ala Ala Gly Pro
 565 570 575

Pro Gly Pro Ala Gly Pro Val Gly Glu Arg Gly Glu Gln Gly Ala Pro
 580 585 590

Gly Pro Ser Gly Phe Gln Gly Leu Pro Gly Pro Pro Gly
595 600 605

Glu Ser Gly Lys Pro Gly Asp Gln Gly Val Pro Gly Glu Ala Gly Ala
610 615 620

Pro Gly Leu Val Gly Pro Arg Gly Glu Arg Gly Phe Pro Gly Glu Arg
625 630 635 640

Gly Ser Pro Gly Ala Gln Gly Leu Gln Gly Pro Arg Gly Leu Pro Gly
645 650 655

Thr Pro Gly Thr Asp Gly Pro Lys Gly Ala Thr Gly Pro Ala Gly Pro
660 665 670

Asn Gly Ala Gln Gly Pro Pro Gly Leu Gln Gly Met Pro Gly Glu Arg
675 680 685

Gly Ala Ala Gly Ile Ala Gly Leu Lys Gly Asp Arg Gly Asp Val Gly
690 695 700

Glu Lys Gly Pro Glu Gly Ala Pro Gly Lys Asp Gly Ala Arg Gly Leu
705 710 715 720

Thr Gly Pro Ile Gly Pro Pro Gly Pro Ala Gly Pro Asn Gly Glu Lys
725 730 735

Gly Glu Ser Gly Pro Pro Gly Pro Ser Gly Ala Ala Gly Ala Arg Gly
740 745 750

Ala Pro Gly Glu Arg Gly Glu Pro Gly Ala Pro Gly Pro Ala Gly Phe
755 760 765

Ala Gly Pro Pro Gly Ala Asp Gly Gln Pro Gly Ala Lys Gly Glu Gln
770 775 780

Gly Glu Pro Gly Gln Lys Gly Asp Ala Gly Ala Pro Gly Pro Gln Gly
785 790 795 800

Pro Ser Gly Ala Pro Gly Pro Gln Gly Pro Thr Gly Val Thr Gly Pro
805 810 815

Lys Gly Ala Arg Gly Ala Gln Gly Pro Pro Gly Ala Thr Gly Phe Pro
820 825 830

Gly Ala Ala Gly Arg Val Gly Pro Pro Gly Pro Asn Gly Asn Pro Gly
835 840 845

Pro Pro Gly Pro Pro Gly Ser Ala Gly Lys Asp Gly Pro Lys Gly Val
850 855 860

Arg Gly Asp Ala Gly Pro Pro Gly Arg Ala Gly Asp Pro Gly Leu Gln
865 870 875 880

Gly Pro Ala Gly Pro Pro Gly Glu Lys Gly Glu Pro Gly Glu Asp Gly
885 890 895

iec030029pctseq.txt

Pro Ala Gly Pro Asp Gly Pro Pro Gly Pro Gln Gly Leu Ala Gly Gln
900 905 910

Arg Gly Ile Val Gly Leu Pro Gly Gln Arg Gly Glu Arg Gly Phe Pro
915 920 925

Gly Leu Pro Gly Pro Ser Gly Glu Pro Gly Lys Gln Gly Ala Pro Gly
930 935 940

Ser Ala Gly Asp Arg Gly Pro Pro Gly Pro Val Gly Pro Pro Gly Leu
945 950 955 960

Thr Gly Pro Ala Gly Glu Pro Gly Arg Glu Gly Asn Pro Gly Ala Asp
965 970 975

Gly Leu Pro Gly Arg Asp Gly Ala Ala Gly Val Lys Gly Asp Arg Gly
980 985 990

Glu Thr Gly Pro Val Gly Ala Pro Gly Ala Pro Gly Ala Pro Gly Ala
995 1000 1005

Pro Gly Pro Val Gly Pro Thr Gly Lys Gln Gly Asp Arg Gly Glu
1010 1015 1020

Thr Gly Ala Gln Gly Pro Met Gly Pro Ser Gly Pro Ala Gly Ala
1025 1030 1035

Arg Gly Met Pro Gly Pro Gln Gly Pro Arg Gly Asp Lys Gly Glu
1040 1045 1050

Thr Gly Glu Ala Gly Glu Arg Gly Leu Lys Gly His Arg Gly Phe
1055 1060 1065

Thr Gly Leu Gln Gly Leu Pro Gly Pro Pro Gly Pro Ser Gly Asp
1070 1075 1080

Gln Gly Ala Ala Gly Pro Ala Gly Pro Ser Gly Pro Arg Gly Pro
1085 1090 1095

Pro Gly Pro Val Gly Pro Ser Gly Lys Asp Gly Ser Asn Gly Met
1100 1105 1110

Pro Gly Pro Ile Gly Pro Pro Gly Pro Arg Gly Arg Ser Gly Glu
1115 1120 1125

Pro Gly Pro Ala Gly Pro Pro Gly Asn Pro Gly Pro Pro Gly Pro
1130 1135 1140

Pro Gly Pro Pro Gly Thr Gly Ile Asp Met Ser Ala Phe Ala Gly
1145 1150 1155

Leu Gly Gln Thr Glu Lys Gly Pro Asp Pro Ile Arg Tyr Met Arg
1160 1165 1170

Ala Asp Glu Ala Ala Gly Gly Leu Arg Gln His Asp Val Glu Val
1175 1180 1185

Asp Ala Thr Leu Lys Ser Leu Asn Asn Gln Ile Glu Ser Ile Arg
1190 1195 1200

Ser Pro Glu Gly Ser Lys Lys Asn Pro Ala Arg Thr Cys Arg Asp
1205 1210 1215

Ile Lys Leu Cys His Pro Glu Trp Lys Ser Gly Asp Tyr Trp Ile
1220 1225 1230

Asp Pro Asn Gln Gly Cys Thr Leu Asp Ala Ile Lys Val Phe Cys
1235 1240 1245

Asn Met Glu Thr Gly Glu Thr Cys Val Tyr Pro Thr Pro Ser Ser
1250 1255 1260

Ile Pro Arg Lys Asn Trp Trp Thr Ser Lys Thr Lys Asp Lys Lys
1265 1270 1275

His Val Trp Phe Ala Glu Thr Ile Asn Gly Gly Phe His Phe Ser
1280 1285 1290

Tyr Gly Asp Glu Asn Leu Ser Pro Asn Thr Ala Ser Ile Gln Met
1295 1300 1305

Thr Phe Leu Arg Leu Leu Ser Thr Glu Gly Ser Gln Asn Val Thr
1310 1315 1320

Tyr His Cys Lys Asn Ser Ile Ala Tyr Met Asp Glu Glu Thr Gly
1325 1330 1335

Asn Leu Lys Lys Ala Ile Leu Ile Gln Gly Ser Asn Asp Val Glu
1340 1345 1350

Ile Arg Ala Glu Gly Asn Ser Arg Phe Thr Tyr Ser Val Leu Glu
1355 1360 1365

Asp Gly Cys Thr Lys His Thr Gly Lys Trp Gly Lys Thr Val Ile
1370 1375 1380

Glu Tyr Arg Leu Gln Lys Thr Ser Arg Leu Ser Ile Val Asp Thr
1385 1390 1395

Ala Pro Met Asp Ile Gly Gly Ala Asp Gln Glu Phe Gly Val Asp
1400 1405 1410

Ile Gly Pro Val Cys Phe Leu
1415 1420

References

1. Jenkins JK, Hardy KJ. Biological modifier therapy for the treatment of rheumatoid arthritis. *Am J Med Sci*, 2002,323(4):197-205.
2. Danos O, Malligan MC. Safe and efficient generation of recombinant retrovirus with amphotropic host ranges. *Proc Natl Acad Sci USA*,1988,85:6460-6465.
3. Roessler BJ, Allen ED, Wilson JM. Adenoviral-mediated gene transfer to rabbit synovium in vivo. *J Clin Invest*,1993,92:1085-1092.
4. Trentham DE, Dynesius-Trentham RA, Orav EJ, et al. Effects of oral administration of type II collagen on rheumatoid arthritis. *Science*, 1993,261: 1727-1730,
5. Sandell LJ, Prentice HL, Kravis D, Upholt WB. Structure and sequence of the chicken type II procollagen gene . *J Biol Chem* , 1984,259 (12) 7826-7834.
6. Horton RM, Hunt HD, Ho SN, et al. Engineering hybrid genes without the use of restriction enzymes: gene splicing by overlap extension. *Gene*,1989, 77:61-68.
7. Sambook J, Fritsch EF, Maniatis T. Molecular cloning:a laboratory manual. 2nd ed Cold Spring Harbor Laboratory Press,1989.
8. Nah DH, Upholt WB. Type II collagen mRNA containing an alternatively spliced exon predominates in the chick limb prior to chondrogenesis. *J Biol Chem*,1991, 266 34:23446-23452.
9. Rousseau JC, Farjanel J, Boutillon MM, et al. Processing of type XI collagen. Determination of the matrix forms of the alpha 1 (XI) chain. *J Biol Chem*, 1996,271(39): 23743-8.
10. Snellman A,Keranen MR, Hagg PO, et al. Type XIII collagen forms homotrimers with three triple helical collagenous domains and its association into disulfide-bonded trimers is enhanced by proly 4-hydroxylase. *J Biol Chem*, 2000, 275(12):8936-44.
11. Young MF, Vogeli G, Nunez AM, et al. Isolation of cDNA and genomic DNA clones encoding type II collagen. *Nucleic Acids Res*, 1984,12 (10): 4207-4228.
12. Marshall GE, Konstas AGP, Lee WR. Collagens in ocular tissues. *BrJ Ophthalmol*, 1993,77:515-524.

13. Seery CM, Davision PF. Collagen of the bovine vitreous. *Invest Ophthalmol Vis Sci*, 1991, 32:1540-1550.

14. Huerre-Jeanpierre C, Mattei MG, Weil D, et al. Further evidence for the dispersion of the human fibrillar collagen genes. *Am J Hum Genet*, 1986, 38(1): 26-37.

15. Ausar SF, Beltramo DM, Castagna LF, et al. Treatment of rheumatoid arthritis by oral tolerance of bovine tracheal type II collagen. *Rheumatol Int*, 2001, 20 :138-144.

16. Barnett ML, Combitchi D, Trentham DE. A pilot trial of oral type II collagen in the treatment of juvenile rheumatoid arthritis. *Arthritis & Rheumatism*, 1996, 39 4:623-628.

17. Kim WU, Lee WK, Ryoo JW, et al. Suppression of collagen-induced arthritis by single administration of poly(lactic-co-glycolic acid) nanoparticles entrapping type II collagen: a noval treatment strategy for induction of oral tolerance. *Arthritis Rheum*, 2002, 46:1109-20.